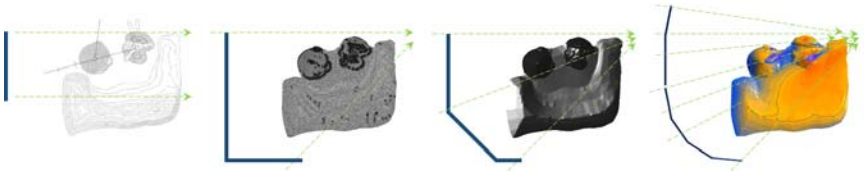
COAL-GEN™

AUGUST 20–22, 2014
NASHVILLE, TENNESSEE
MUSIC CITY CENTER, HALL B

Good Neighbors –

Wind Fence Design Considerations to Minimize Fugitive Coal Dust Complaints



Keith L. Kibbee PE, CH2M HILL

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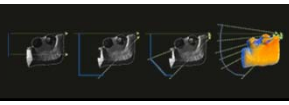
Agenda

Steps to achieve a high performing wind fence design

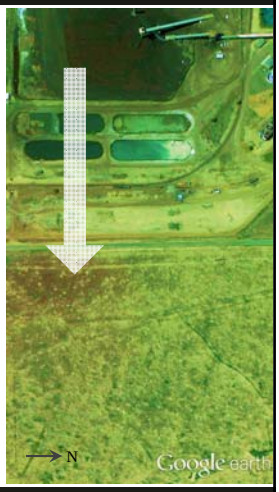
- Discovery:
  Understand the problem, constraints, and opportunities
- Qualitative Preliminary Design:
  Leverage guidelines from previous experience
- Quantitative Design Validation & Refinement
  Use simulation to visualize and improve performance virtually



Discovery

Understand the problem

- Site observation



Discovery

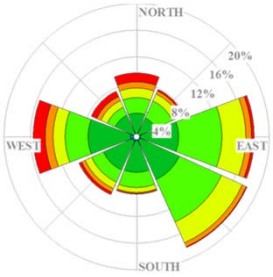
Understand the problem

- Ask site personnel

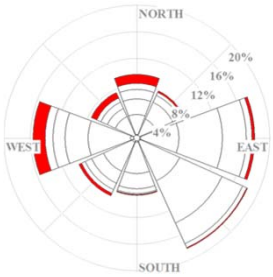
Discovery

Understand the problem

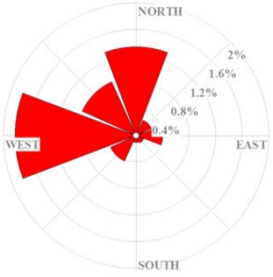
- Check wind statistics



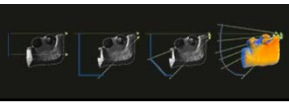
Prevailing winds out of the East and Southeast…



… fugitive emissions at > 10 m/s…



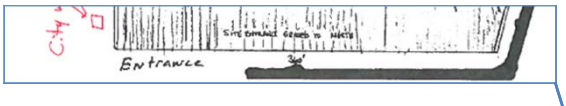
…problematic winds are out of the West and North

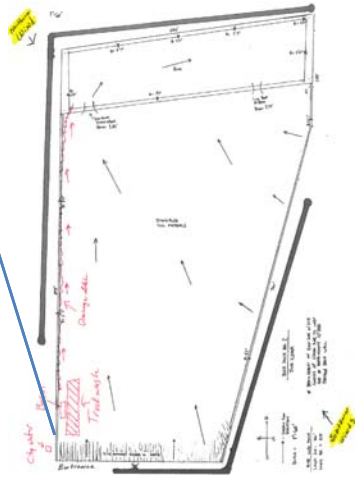


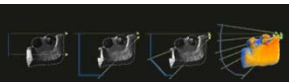
Discovery

Sketch & visualize wind fence

- Property boundaries



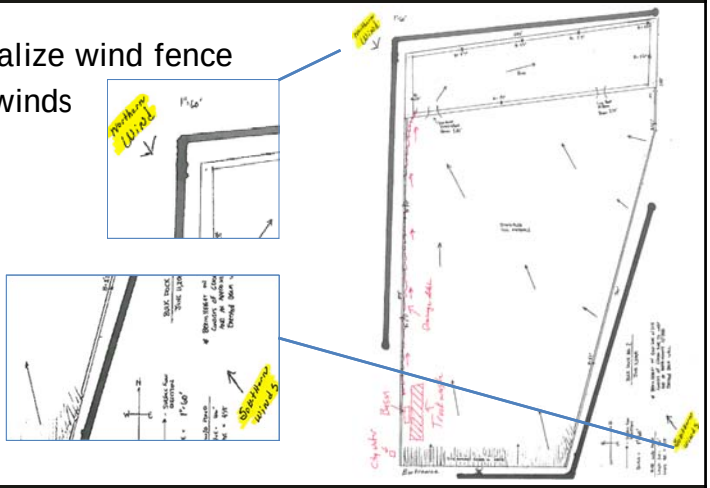




Discovery

Sketch & visualize wind fence

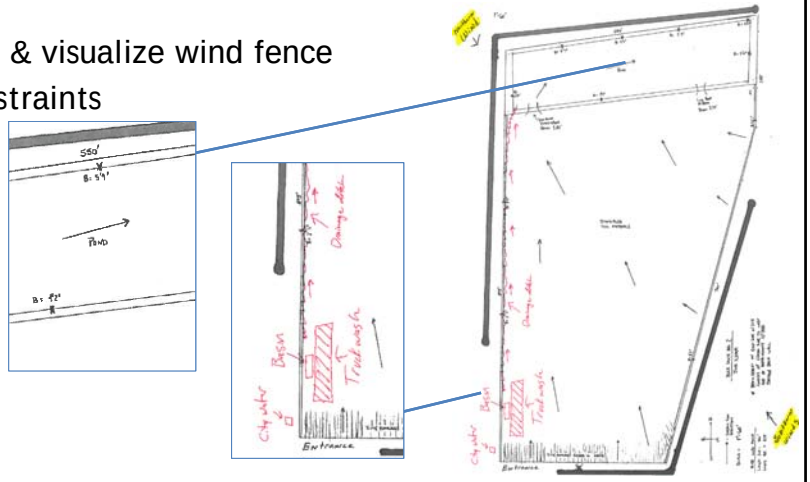
- Prevailing winds



Discovery

Sketch & visualize wind fence

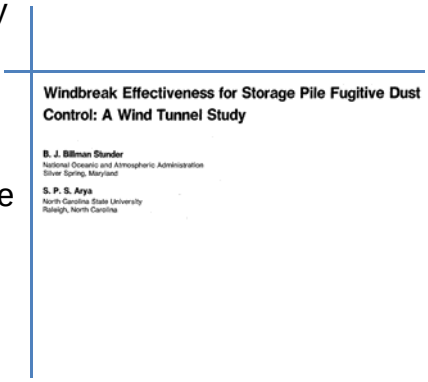
- Constraints



Qualitative Preliminary Design

Leverage previous research

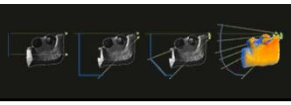
- Wind fence material porosity
- Wind fence height
- Wind fence length
- Wind direction
- Distance between wind fence and pile



Windbreak Effectiveness for Storage Pile Fugitive Dust Control: A Wind Tunnel Study

B. J. Billman Stunder
National Oceanic and Atmospheric Administration
Silver Spring, Maryland

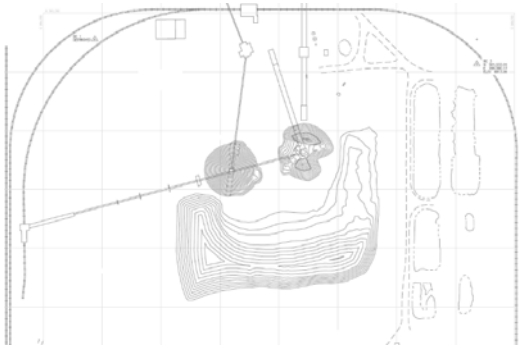
S. P. S. Arya
North Carolina State University
Raleigh, North Carolina

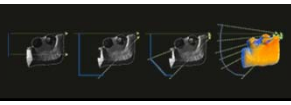


Quantitative Analysis

Setting up the model

- Pile topography

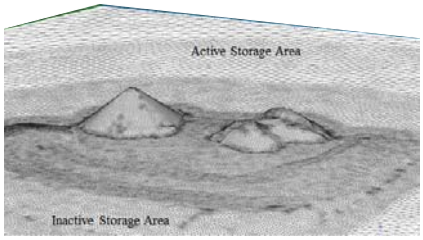


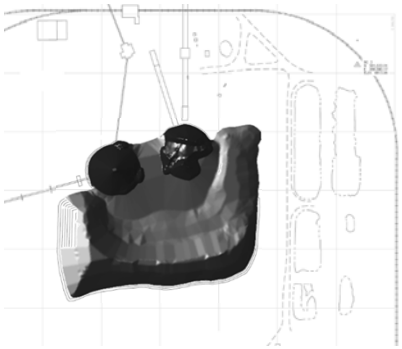


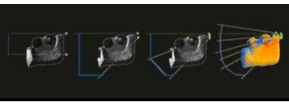
Quantitative Analysis

Setting up the model

- Render geometry
- Produce computation mesh



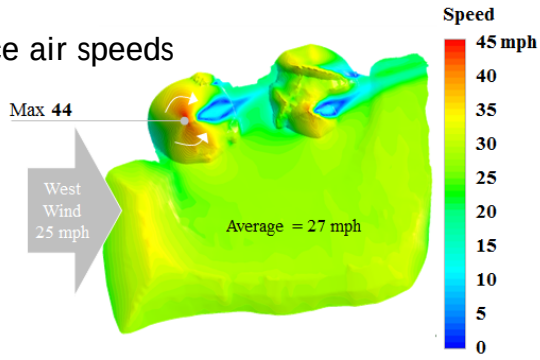


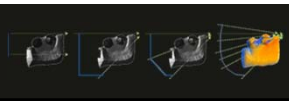


Quantitative Analysis

Airflow Simulation

- Run baseline model
- Calculate near-surface air speeds

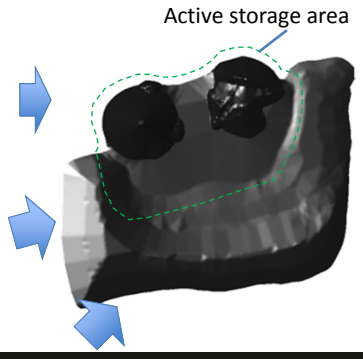




Design Validation & Refinement

Identify areas of concern

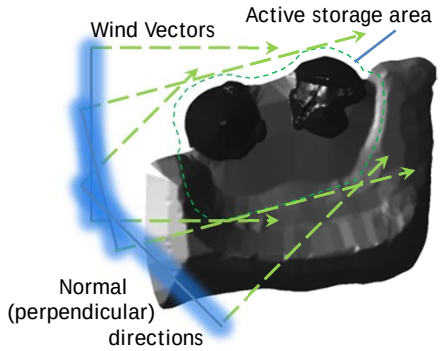
- Active vs Inactive Storage Areas
- Problematic wind directions



Design Validation & Refinement

Apply & guidelines and test

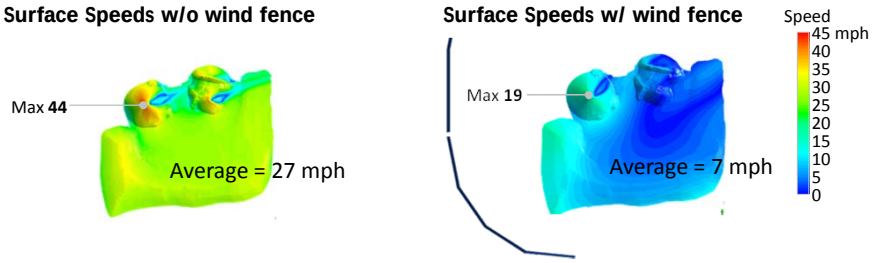
- Pile boundaries vs wind directions

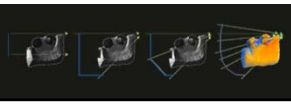


Design Validation & Refinement

Analysis

- Run wind fence models
- Compare to baseline





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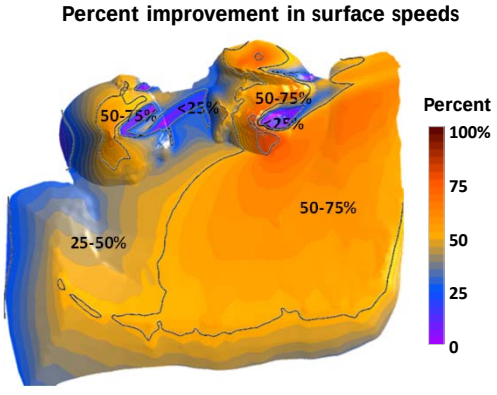
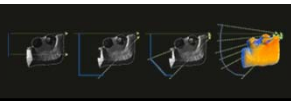
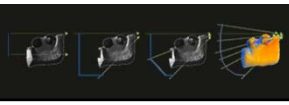




Wrap-up

Steps to achieve a high performing wind fence design

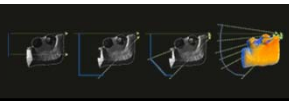
- Look and listen and observe site operations
  - Ask site staff
  - Perform a site walk
  - Check wind statistics



Wrap-up

Steps to achieve a high performing wind fence design

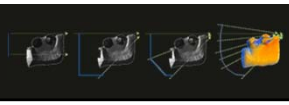
- Leverage previous wind fence studies
  - Height: taller than piles
  - Length: protection for active pile handling areas normal to problematic wind directions
  - Positioning: Distance of at least one fence height from pile
  - Porosity: Solid works, but porous (40-50%) performs well.



Wrap-up

Steps to achieve a high performing wind fence design

- Use advanced simulation to quantify and improve upon expected wind fence performance.
- This last step is inexpensive peace-of-mind – sometimes costing just 1-2% of the capital expense of a wind fence.



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Thank you!

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